Weekly Report

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Done

1) Finished writing the paper for edutainment 2016. I prepared my questions and ideas on revising the paper first, and discussed with Liu and revised the wordings. Based on my experience in writing the survey, I found bugs in writing beyond reviewers' suggestions. Besides, we had heated discussion on the structure and logic of the paper and consult with our seniors.

2) Finished taking final exams. However, I am writing course essays these days.

3) Start working on netease again. Discussed and improved the models with teachers and peers. Writing modules for coders. A document written in English is followed on next page.

To do

1) Prof Wu has made a todolist for all of us. Before 1.31, write related work. Now I am collecting related papers. The themes will include: Dynamic network visualization, Social media visualization, Social network analysis, Time-series correlation and Game data mining. I will ask Panpan Xu for advice.

2) I will supervise all the members in our team and allocate proper tasks for them to finish, since all the members has finished their final exams now.

玩家交互与其消费决策的模型建立和数据支持

netease group

Model

We use Cox proportional hazard model to simulate how players' communications dynamically affects players' consuming behavior. We specify the following model:

$$
\begin{aligned}
& h(t, N_j^k, X_i^k, X_j, S(X_i, X_j)^k, SH_{i,j}^k, C_j, C_j', P_j) \\
=& h_0(t) \exp[\sum_{k=1,2,3} N_j^k(t) S(X_i, X_j)^k \beta_{\text{infl}_{i\to j}}^k + \sum_{k=1,2,3} N_j^k(t) SH_{i,j}^k \beta_{\text{infl}_{sh}}^k \\
& + \sum_{k=1,2,3} N_j^k(t) \beta_N^k + \sum_{k=1,2,3} S(X_i, X_j)^k \beta_{\text{spont}_{i-j}}^k + \sum_{k=1,2,3} SH_{i,j}^k \beta_{\text{spont}_{sh}}^k \\
& + \sum_{k=1,2,3} X_i^k \beta_{\text{spont}_i}^k + \sum_{k=1,2,3} N_j^k(t) X_i^k \beta_{\text{infl}}^k + X_j \beta_{\text{spont}}^j + X_j \sum_{k=1,2,3} N_j^k(t) \beta_{\text{susc}}^k + C_j \beta_c \\
& + C_j' \beta_{c'} + P_j \beta_x]
\end{aligned}
$$

Where:

- h stands for the hazard rate that player j is going to buy one certain kind of goods (goods are divided into many kinds). It is an function of:
  - X_i^k refers to aggregation attributes of the group of core players which has influenced j , where j is an ordinary player. i^k and j are connected through a certain kind of goods (denoted as kg). X_j is the set of individual attributes of j. The core players can be divided into 3 categories based on their consumptions (k=1,2,3 means: high, middle, low level of consumption). We assume that j is affected by 3 categories of core players simultaneously. That's why there are so many Σs in the formula above.
  - $N_j^k(t)$ represents the average number of messages sent to j from i^k.
  - $S(X_i, X_j)$ difference between X_i, X_j on their coreness.
  - $SH_{i,j}^k$ represents shared players between player i^k and player j derived from the communication network (*Jaccard coefficients*).
  - C_j represents the number of goods which belongs to kg bought by j in the last time window.
  - C_j' represents the number of goods of other kinds bought by j in the last time window.
  - P_j is the proportion of players in j's peers. (Here, peers refers to those who had communications with j in current time window)
- $h_0(t)$ is a baseline hazard function that is left unspecified but must be positive (=the hazard when all covariates are 0)

- exp[...] is the covariate effect function.

Now let's step into the exp[...]. The first two items in the equation reflect two Sociology mechanisms, namely **social influence mechanism** (or assortivity) and **triadic closure mechanism**, respectively. And they are what we need to depict in our visual exploration system. The remaining items are the control covariates. The meanings of coefficients (different βs):

- $\beta^k_{\text{infl}_{i\to j}}$: estimate the effect of the dyadic attributes (e.g., "same age") on the degree to which i^k influence j to consume, above and beyond j's likelihood to consume spontaneously.
- $\beta^k_{\text{infl}_{sh}}$: estimates the effect of shared players on the degree to which i^k influence j to consume, above and beyond j's propensity to consume spontaneously.
- β^k_N estimates the effect of communications between players of category k(i.e., i^k) and player j on the i's consuming behavior.
- $\beta^k_{\text{spont}_{i-j}}$: the effect of a dyadic relationship between core players i^k and player j on the tendency for j to consume spontaneously.
- $\beta^k_{\text{spont}_{sh}}$: the effect of shared players of players i^k and j in communication network on the tendency for j to consume spontaneously.
- $\beta^k_{\text{spont}_i}$: the propensity for peers of players i^k to consume spontaneously in the absence of influence ($N^k_j(t) = 0$).
- β^k_{infl}: the impact of players i^k's attributes on i^k's ability to influence player j to consume, above and beyond j' s propensity to consume spontaneously.
- β^j_{spont}: the propensity of player j to spontaneously consume in the absence of influence ($N^k_j(t) = 0$).
- β^k_{susc}: the impact of player j's attributes on j's to consume as a result of influence above and beyond j's propensity to adopt spontaneously.
- β_c: the effect of players i^k's previous consumption habits of kg on the tendency for j to consume.
- $\beta_{c'}$: the effect of players i^k's previous consumption habits of other kinds of goods on the tendency for j to consume.
- β_x: the effect of player i^k's peers' consumption of kg on the tendency for j to consume.

Data

We employ *Partial Likelihood Function* to estimate parameters thus we do not have to find out what $h_0(t)$ is. We adopt time window sampling strategy to 'split' the time period. We set a threshold (median of buying amount) to judge whether player k is 'dead' in survival analysis.

CURRENTLY, the attributes used for individual players are: *online time, game level, gender, xiulian, xiuwei, VIP level, killing success, degree(in a network)*. The coreness: $eigenvector\_centrality * (gamelevel + xiuwei) * (1 + xiulian) * (1 + VIP\ level)$. The $SH^k_{i,j}$: $\frac{\text{peers of } i^k \text{ intersection with } peers\ of\ j}{\text{peers of } i^k \text{ union with } peers\ of\ j}$